

Appl. No. 10/400,528

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Amendments to the Drawings:

Sheets 1/16, 2/16, 3/16 and 11/16 have been amended.

Figs. 1, 2, 3 and 10A have been amended by adding the label "Prior Art".

In Fig. 1, the reference character "514" identifying the element also identified as C_{PICH} has been replaced with reference character "515".

In Fig. 2, the reference character "501" has been replaced with reference character "503".

Attachment: Replacement Sheets
Annotated Sheets Showing Changes

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REMARKS/ARGUMENTS**Amendments to Specification**

Amendments have been made in the specification by replacing the paragraph starting on p. 8, line 4 and the first two paragraphs starting on p. 21, line 1. On page 8 the reference character associated with C_{PICH} was changed from 504 to 515 for consistency with the drawings. On page 21 several minor grammatical issues were corrected.

Amendments to Drawings

Figs. 1, 2, 3 and 10A have been amended by adding the label "Prior Art".

In Fig. 1, the reference character "514" identifying the element also identified as C_{PICH} has been replaced with reference character "515".

In Fig. 2, the reference character "501" has been replaced with reference character "503".

The amendments have been made in response to the Examiner's objections of page 2 of the Office Action.

Status of Claims

Claims 1 to 50 remain in the application.

Claim Amendments

Claim 1 has been amended as follows:

"A transmitter comprising:

N transmit antennas, where $N \geq 2$, each transmit antenna for transmitting a respective one of N transmit signals to a common receiver;

~~wherein the transmitter is adapted to transmit a respective one of N transmit signals from each of the N antennas,~~ the N transmit signals collectively ~~containing~~ comprise a plurality N of main signals, and a plurality of delayed main signals each delayed main signal being a delayed version of one of the main signals, wherein each transmit signal comprises a combination of [[a]]

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only one respective main signal of the plurality N of main signals and at least one respective delayed main signal of the ~~N~~ plurality of delayed main signals". The underscored text indicates newly added text and the strikethrough text indicates text deleted from the claim.

Claim 5 has been amended to replace the expression "not included in any main signal" with the expression "combined with at least one main signal".

Claim 6 has been amended to include a limitation that the first antenna and second antenna are "for transmitting to a common receiver".

Claim 48 has been amended as follows:

"A method of transmitting comprising:

delaying each of N main signals, by each of at least one respective delay to produce at least one respective delayed main signal;

transmitting from each of $N \geq 2$ antennas a respective signal to a common receiver comprising only one of the main signals combined with at least one of the delayed main signals, such that the N antennas collectively transmit the plurality of N main signals and the plurality of delayed main signals". The amendment to claim 48 is consistent with the amendments made to claim 1 described above.

35 U.S.C 112 Claim Rejections

The Examiner has rejected claim 5 under 35 U.S.C. 112 as failing to comply with the written description requirement. The Examiner alleges that the specification does not include a description as to what is meant by transmitting a code-separated channel "not included in the main signal". The Examiner alleges that in Fig. 4A, all the main signals are code separated and they or their delayed versions are transmitted.

Amended claim 5 recites "each transmit signal further comprises at least one additional code separated channel combined with at least one main signal". Fig. 4A illustrates the main signals $s_A(t)$ and $s_B(t)$ being multiplied by respective virtual spatial reflector functions in blocks 47 and 49, respectively. The output of blocks 47 and 49 are then multiplied by respective gain

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functions GA1 and GB1. On page 25, line 32, the specification states that for the output of multiplier 60 "the data stream is then combined with other user channels or common signalling channels such as pilot channel (PICH) or primary synchronization channel (PSCH) etc., and is transmitted via antenna A 70". Applicant submits that it is these other types of channels that are examples of "at least one additional code separated channel combined with at least one main signal".

An example of other user channels or common signalling channels combined with a main signal is illustrated in Fig. 4C. Fig. 4C is described starting on page 29, line 4 as "a block diagram of how the embodiments of Figure 4A, using the generic functionality of Figure 4B can be applied to the CDMA transmitter of Figure 2". In Fig. 4C signals on generic channels, generic meaning not user specific, are combined using summer 614. User specific channels, which are each spread by respective spreading codes are combined using summer 608. The output of summer 608 is then scrambled using scrambling function 610. The output of scrambling function 610 and summer 614 are added to the output of the output of Spatial Reflector Function 604, which is the main signal for antenna 624.

Applicant submits that the combination of Figures 4A and 4C and the corresponding description of these figures fully supports amended claim 5.

35 U.S.C 102 Claim Rejections

Controlling case law has frequently addressed rejections under 35 U.S.C. § 102 "For a prior art reference to anticipate in terms of 35 U.S.C. Section 102, every element of the claimed invention must be identically shown in a single reference." Diversitech Corp. v. Century Steps, Inc., 850 F.2d 675, 677, 7 U.S.P.Q.2d 1315, 1317 (Fed. Cir. 1988; emphasis added). The disclosed elements must be arranged as in the claim under review. See Lindemann Machinefabrik v. American Hoist & Derrick Co., 730 F.2d 1452, 1458, 221 U.S.P.Q. 481, 485 (Fed. Cir. 1984). If any claim, element, or step is absent from the reference that is being relied upon, there is no anticipation. Kloster Speedsteel AB v. Crucible, Inc., 793 F.2d 1565, 230 U.S.P.Q. 81 (Fed. Cir. 1986; emphasis added). The following analysis of the present rejections is respectfully offered with guidance from the foregoing controlling case law decisions.

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The Examiner has rejected claims 1, 6, 7 and 48 under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,178,333 (Feuerstein et al, hereinafter Feuerstein).

The Feuerstein reference discloses a system and method for avoiding nulls in a composite radiation pattern synthesized from a plurality of antenna beams. Feuerstein discloses the use of delays in signal paths for each beam of a plurality of antenna beams utilized to synthesize the desired radiation pattern in order to avoid destructive combining of the beams. (Abstract). Furthermore, in the Technical Field of the Invention, the patent is described as being related to "the simulcasting of signals from a multibeam antenna system and, more particularly, to systems and methods for delaying signals simulcast from various multibeam antennas to avoid destructive nulls". The invention is directed to overcoming a problem of phase nulling when multiple beams are simulcast on multiple beams of an antenna.

The present application is directed to systems and methods for transmitting multiple substreams on an array of transmit antennas. The multiple substreams each include a distinct main signal and one or more delayed versions of one or more of the main signals. This, for example, enables "virtual" MIMO type transmission between the array of transmit antenna and a single receive antenna.

To further clarify the difference between Feuerstein and the present application, the following background is provided. Figure 1 below shows a typical MIMO transmitter (Tx) and receiver (Rx), each having two antennas. The transmitter transmits signal $S_1(t)$ from a first antenna (Tx ANT 1) and $S_2(t)$ from a second antenna (Tx ANT 2). The signal from each transmit antenna is received by each receive antenna such that a first receive antenna (Rx ANT 1) receives a signal that is a function of $S_1(t)$ and $S_2(t)$, $F[S_1(t) + S_2(t+\Delta t)]$. Based on a difference in the path length between Tx ANT 1 and Rx ANT 1 and Tx ANT 2 and Rx ANT 1, the $S_2(t)$ signal is delayed with respect to the $S_1(t)$ signal by Δt . Similarly, a second receive antenna (Rx ANT 2) receives a signal that is a function of $S_1(t)$ and $S_2(t)$, $F[S_2(t) + S_1(t+\Delta t)]$. This is a considerably simplified model of a MIMO system as typically there are many paths that may occur on the channel between the transmitter and receiver resulting in multiple versions of each of the transmitted signals being received at each receive antenna.

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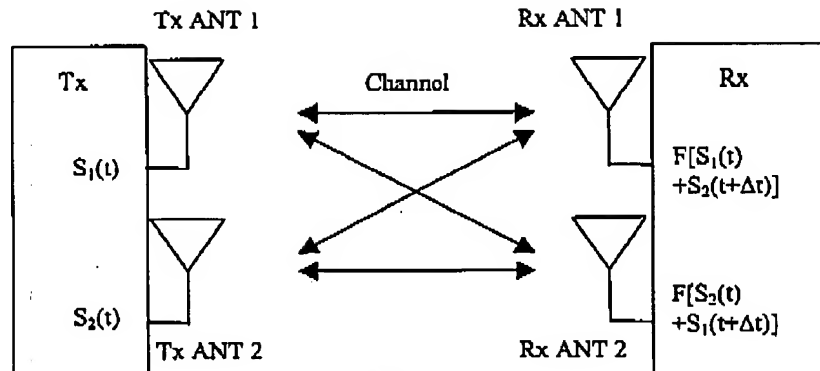


Figure 1

Figure 2 below shows an example of how some embodiments of the present invention enable a virtual MIMO system in which a transmitter (Tx) has two or more transmit antennas and a receiver (Rx) has only a single antenna. In Figure 2, a first transmit antenna (Tx ANT 1) transmits signal $S_1(t)$ and a delayed version of the signal $S_1(t+\Delta t)$ and the second transmit antenna (Tx ANT 2) transmits signal $S_2(t)$ and a delayed version of the signal $S_2(t+\Delta t)$. The signals transmitted from each transmit antenna are transmitted over the channel and received by the single receive antenna (Rx ANT) such the received signal is a function of $S_1(t)$, $S_1(t+\Delta t)$, $S_2(t)$ and $S_2(t+\Delta t)$, $F[S_1(t) + S_1(t+\Delta t) + S_2(t) + S_2(t+\Delta t)]$. Adding a delayed version of each of the signals $S_1(t)$ and $S_2(t)$ to the respective transmit signals of each transmit antenna acts to create an artificial path delay (or a "virtual spatial reflection") and allows the single receive antenna to receive signals that can be treated as a MIMO signal and the post processed to recover $S_1(t)$ and $S_2(t)$.

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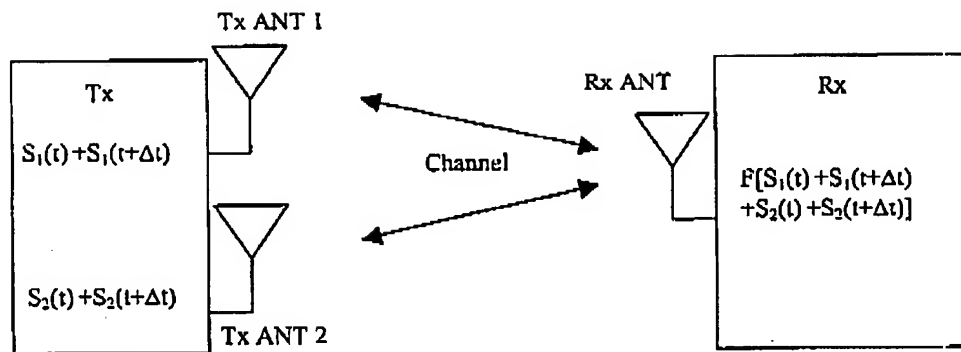


Figure 2

Feuerstein on the other hand, discloses multiple directional, substantially non-overlapping beams broadcast from a transmitter array to collectively simulcast over a given sector (column 4, lines 37-40). Multiple transmitter arrays may be used to provide coverage for multiple sectors, see Figures 5, 7, 8, 9 and 10. For example, when all the transmit beams for a given sector are transmit from a common transmitter array, the beams all simulcast the same signal on the multiple beams, see for example Figure 7 and the corresponding table in column 9. The table shows that Antenna Panel 501 transmits non-delayed versions of a signal on beams 121,122,123,124 for the Alpha sector, Antenna Panel 502 transmits non-delayed versions of a signal on beams 125,126,127,128 for a Beta sector, and Antenna Panel 503 transmits non-delayed versions of a signal on beams 129,130,131,132 for a Gamma sector. When the transmit beams for a given sector are transmit from more than one transmitter array, i.e. to orient the coverage of the sector in a slightly different direction than a single antenna array can provide, the beams for that sector simulcast delayed and non-delayed versions of the same signal respectively on the multiple beams, see for example Figure 8 and the corresponding table in column 10. The table shows that Antenna Panel 501 transmits a delayed version of a signal for the Gamma sector on beam 121 and non-delayed versions of a signal for the Alpha sector on beams 122,123,124, Antenna Panel 502 transmits a delayed version of the signal for the Alpha sector on beam 125 and non-delayed versions of a signal for the Beta sector on beams 126,127,128, and Antenna Panel 503 transmits a delayed version of the signal for the Beta sector on beam 129 and non-delayed versions of the signal for the Gamma sector on beams 130,131,132.

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Furthermore, in Feuerstein, a mobile terminal acting as a receiver located in a given sector (Alpha, Beta, or Gamma) would receive a signal from only one of the directional beams of the one or more antenna arrays transmitting in the given sector. A mobile terminal would not receive signals from all the antenna beams of the sector. The amended independent claims of the present application recite that each transmit antenna for transmitting a respective one of N transmit signals to a common receiver. Therefore, a common receiver receives all the signals transmitted by the N transmit antennas. Figure 3 below illustrates an example based on Figure 8 and the corresponding table in column 10 of Feuerstein, in which a mobile terminal receives a signal transmitted on Beam 122. Clearly, not all of the directional beams forming the Alpha sector are received by the mobile terminal.

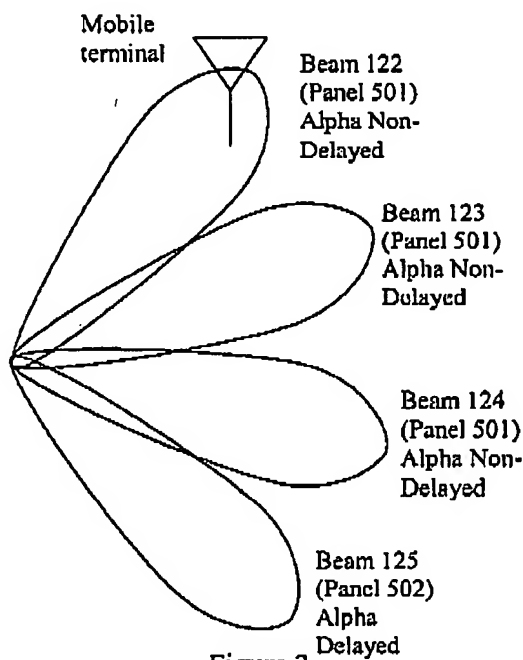


Figure 3

Based on the above description of the differences between some embodiments of the present application and what is disclosed in Feuerstein, Applicant believes the following arguments will clearly show that the claims of the present application patentably distinguish over Feuerstein.

The Examiner alleges that Feuerstein discloses "a transmitter comprising: N transmit

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antennas, where $N \geq 2$ in the form of the elements indicated by reference character 401 and described in column 5, lines 19-40. The Examiner further alleges that Feuerstein discloses "wherein the transmitter is adapted to transmit a respective one of N transmit signals from each of the N antennas" by equating Beams 1-12 of Figure 6 (described at column 7, lines 1-15) to the N transmit beams. The Examiner then alleges that "the N transmit signals collectively containing a plurality N of main signals and a plurality of delayed main signals" is disclosed by Feuerstein in the form α , β and γ in Figure 6 being equal to "main signals" of the recited claim and outputs of delay elements 621, 622, 623 being equal to "delayed main signals". Finally, the Examiner alleges that "wherein each transmit signal comprises a combination of a respective main signal of the plurality of main signals and at least one respective delayed main signal of the N delayed main signals" is disclosed in Feuerstein by switch matrices 651, 652, 662 combining α , β and γ and the delayed versions of α , β and γ in different combinations. Applicant disagrees with the Examiner's characterization of Feuerstein.

The Examiner equates the antenna elements 401 of antenna array panel 400 in Figure 4 of Feuerstein to N antennas in claim 1. The claim further recites that the transmitter is adapted to transmit a respective one of N transmit signals from each of the N antennas. There is no suggestion or disclosure in Feuerstein that the number of transmit signals transmit from panel 400 is equal to the number antenna elements, or that each antenna element transmits a respective signal. In fact, this would be contrary to the operation of how the antenna array would operate. Feuerstein discloses that a beam forming matrix is used to provide antenna beams. The beam forming matrix provides "the signal applied to one of the inputs as components with a proper phase progression at the elements of panel 400 to result in the desired narrow antenna beam" (column 5, lines 24-33). Therefore multiple antenna elements 401 are required to transmit the antenna beams. Applicant submits the antenna elements 401 are not equivalent to the N transmit antenna recited in claim 1.

Furthermore, the Examiner has equated the N transmit signals with Beams 1-12 in Figure 6. Feuerstein discloses that Beams 1-12 correspond to beams used in multiple synthesized sectors, for example α , β and γ . Figures 7, 8, 9 and 10 illustrate different configurations of how Beams 1-12 can be used to provide synthesized sectors α , β and γ . Each synthesized sector α , β

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and γ may contain one or more of Beams 1-12. In the example of Figure 7, each of the sectors has three of the 12 beams. In the example of Figure 10, sector α has only two beams of the 12 beams, sector β has four beams of the 12 beams and sector γ has six beams of the 12 beams. Each of these examples are illustrated using multiple, specifically three, antenna panels, each having a plurality of antenna elements 401. Applicant submits that there is no one-to-one correlation in the number of antenna elements 401 and the number of antenna beams in Feuerstein, as alleged by the Examiner. Even if one were to consider that each array panel antenna is a separate antenna, the examples disclosed in Feuerstein disclose twelve transmit signals transmitted from 3 array panel antennas. There is still no one-to-one correlation in the number of antenna elements 401 and the number of antenna beams in Feuerstein. As there is a one-to-one correlation in the number of transmit antenna and transmit signals, Applicant submits that Feuerstein does not disclose what is recited in claim 1.

With regard to the amended limitation "wherein each transmit signal comprises a combination of only one respective main signal of the plurality N of main signals and at least one respective delayed main signal of the plurality of delayed main signals" (emphasis added), the amendment clearly defines that only one respective main signal is transmitted by each antenna.

The term "collectively" as recited in claim 1, denotes that all of the N transmit signals together (each of which correspond to the N signals in parallel) contain the plurality N of main signals and the plurality of delayed main signals. Therefore, since each transmit antenna transmits only one main signal, and collectively they transmit all the main signals, each antenna must transmit a different one of the N main signals.

In Feuerstein, the beams of each synthesized sector α , β and γ simulcast a delayed or a non-delayed version of the same signal. In particular, with reference to the four tables in columns 9, 10 and 11, Feuerstein discloses only a single delayed or non-delayed signal for sectors α , β and γ on each of Beams 1-12. Applicant submits that Feuerstein does not suggest or disclose transmitting only one main signal and at least one non-delayed signal on each respective beam of Beams 1-12.

In addition, as discussed above, the amended independent transmitter claims of the

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present application all recite that each transmit antenna is for transmitting a respective one of N transmit signals to a common receiver. Feuerstein does not suggest or disclose each transmit beam from each antenna array being transmitted to a common receiver.

For at least the above reasons, Feuerstein does not identically disclose every element of the claimed invention as required in an anticipation rejection.

Amended claim 6 recites similar subject matter to claim 1 except that the claim is limited to transmitting a first main signal and a second main signal. The amended claim recites that the first linear combination and the second linear combination collectively transmit all of the first and second main signals and corresponding first and second delays versions of the first and second main signals. Feuerstein does not anticipate claim 6 for at least the same reason: discussed above with regard to claim 1.

Claim 7 is dependent on claim 6. Feuerstein does not anticipate claim 7 for at least the same reasons as independent claim 6.

Amended claim 48 recites similar subject matter to amended claim 1 in the form of a method. Feuerstein does not anticipate claim 48 for at least the same reasons discussed above with regard to claim 1.

Applicant respectfully requests that the Examiner reconsider and withdraw the anticipation rejection of claims 1, 6, 7 and 48.

35 U.S.C 103 Claim Rejections

The requirements for establishing a *prima facie* case of obviousness as set out in the MPEP Section 2143.01 require that the reference or references when combined teach all of the claimed limitations, that there be a reasonable expectation of success in realizing the claimed invention, and that there be a motivation to combine the references.

The Examiner has rejected claims 2, 3, 33 and 34 under 35 U.S.C. 103(a) as being unpatentable over Feuerstein in view of U.S. Patent No. 6,067,324 (Harrison) and further in view of "A Simple Transmit Diversity Technique for Wireless Communications", October 1988, IEEE Journal on Selected Areas in Communications, pages 1451-1458 (Alamouti).

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Claims 2, 3, 33 and 34 are dependent upon claim 1, either directly or indirectly. For at least the reasons described above with respect to claim 1, Applicant submits that Feuerstein does not disclose all the features of claim 1. Applicant submits that neither Harrison nor Alamouti discloses the features missing from claim 1 that alleged to be disclosed by Feuerstein. Therefore, Applicant submits that the Examiner has failed to satisfy at least the requirement necessary to establish a *prima facie* case of obviousness, namely that the combination of references teach all the limitations of the claim.

In addressing the problem of avoiding nulls when simulcasting signals, Feuerstein discloses that non-delayed and delayed versions of a signal are simulcast on all beams of a synthesized sector. Applicant submits that Feuerstein teaches away from the present invention as Feuerstein discloses simulcasting on each of Beam 1, Beam 2 and Beam 3. There is no suggestion or disclosure that a transmitter is adapted to transmit a respective one of N transmit signals from each of the N antennas, the N transmit signals collectively containing a plurality N of main signals and a plurality of delayed main signals as recited in claim 1. Transmitting only a main signal and at least one delay signal from each antenna as recited in claim 20 is not simulcasting all signals on all beams which is of prime importance to the problem of avoiding nulls during simulcasting, which is the problem that Feuerstein is addressing. As Feuerstein teaches away from the claimed invention, Applicant submits it is improper to combine Feuerstein with the other references in attempting to establish a *prima facie* case of obviousness.

For at least the above-discussed reasons, it is respectfully submitted that the Examiner has failed to meet all the necessary requirements for establishing a *prima facie* case of obviousness against claims 2, 3, 33 and 34. Applicant submits that claims 2, 3, 33 and 34 patentably distinguished over the combination of Feuerstein, Harrison and Alamouti. Applicant respectfully requests that the Examiner reconsider and withdraw the obviousness rejection.

The Examiner has rejected claims 4 and 35 under 35 U.S.C. 103(a) as being unpatentable over Feuerstein, in view of Harrison and Alamouti and further in view of U.S. Patent No. 6,356,528 (Lundby et al, hereinafter Lundby).

Claims 4 and 35 are dependent upon claims 3 and 34, respectively. For at least the reasons discussed above with regard to claims 3 and 34, Applicant submits that claims 4 and 35 patentably distinguish over the combination of Feuerstein, Harrison and Alamouti. Applicant

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submits that Lundby does not disclose limitations missing from Feuerstein, Harrison and Alamouti that are alleged to be disclosed by the Examiner. While one may consider that Lundby discloses the limitation "N transmit signals collectively comprise a plurality N of main signals" Lundby does not disclose "the N transmit signals collectively containing a plurality N of main signals, and a plurality of delayed main signals each delayed main signal being a delayed version of one of the main signals" (emphasis added). Furthermore, as Feuerstein teaches away from the claimed invention, Applicant submits it would be improper to combine Feuerstein with the other cited references, in particular Lundby, in an obviousness rejection of claims 3 and 35, or more generally any of the other claims.

Claims 5, 31, 32, 36 to 47 are all dependent upon claim 1, either directly or indirectly. Claims 8 to 19 are all dependent upon claim 6, either directly or indirectly. The Examiner bases the rejection of these claims on Feuerstein and a selection of other cited references. Feuerstein does not disclose what is recited in claims 1 and 6, respectively, for at least the reasons discussed above in the section responding to the anticipation rejection. Applicant submits that none of the selection of other cited references discloses the features missing from claim 1 or claim 6, which are alleged to be disclosed by Feuerstein. Therefore, Applicant submits that the Examiner has failed to satisfy at least one necessary requirement to establish a prima facie case of obviousness, namely that the combination of references teach all the limitations of the claims.

The Examiner has rejected independent claim 20 under 35 U.S.C. 103(a) as being unpatentable over Feuerstein and U.S. Patent No. 4,217,586 (McGuffin). The Examiner alleges that Feuerstein discloses the limitation of a signal transmitted over a wireless channel from a transmitter having a plurality of N transmit antennas recited in the preamble of the claim. The preamble of the claim recites similar subject matter recited in claim 1. As discussed above, Applicant submits that Feuerstein does not disclose all of the limitations recited in amended claim 1, namely "the N transmit signals collectively comprise a plurality N of main signals, and a plurality of delayed main signals". Therefore, Feuerstein does not disclose all of the limitations recited in claim 20. Applicant submits that McGuffin does not disclose the limitation missing from claim 20, which is alleged to be disclosed by Feuerstein. Applicant submits that the Examiner has failed to satisfy at least one necessary requirement to establish a prima facie case of obviousness, namely that the combination of references teach all the limitations of the claims.

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As Feuerstein teaches away from the claimed invention as discussed above, Applicant submits that it is improper to combine Feuerstein and McGuffin in the manner alleged by the Examiner.

For at least the above-discussed reasons, it is respectfully submitted that the Examiner has failed to meet all the necessary requirements for establishing a *prima facie* case of obviousness against claim 20. Applicant submits that claim 20 patentably distinguished over the combination of Feuerstein and McGuffin. Applicant respectfully requests that the Examiner reconsider and withdraw the obviousness rejection.

Claims 21 to 25 are dependent upon claim 20, either directly or indirectly. The Examiner bases the rejection of these claims 21, 22, 24 and 25 on Feuerstein and a selection of other cited references. Applicant notes that there does not seem to be a particular rejection to claim 23 in the Office Action. Applicant submits that Feuerstein does not disclose what is recited in claim 20. Applicant further submits that none of the selection of other cited references discloses the features missing from claim 20, which are alleged to be disclosed by Feuerstein. Therefore, Applicant submits that the Examiner has failed to satisfy at least one necessary requirement to establish a *prima facie* case of obviousness, namely that the combination of references teach all the limitations of the claims.

The Examiner has rejected independent claim 26 under 35 U.S.C. 103(a) as being unpatentable over Feuerstein, Lundby, McGuffin, and U.S. Patent No. 6,567,462 (Brunner et al, hereinafter Brunner). The Examiner alleges that Feuerstein essentially discloses the limitation of a signal transmitted over a wireless channel from a transmitter having a plurality of N transmit antennas recited in the preamble of the claim. The preamble of the claim recites similar subject matter recited in claim 1. As discussed above, Applicant submits that Feuerstein does not disclose all of the limitations recited in amended claim 1, namely "the N transmit signals collectively comprise a plurality N of main signals, and a plurality of delayed main signals". Therefore, Feuerstein does not disclose all of the limitations that are alleged to be disclosed by the Examiner in claim 26.

The Examiner alleges that Brunner discloses "for each receive antenna, a respective over-sampling analog to digital converter which samples the respective receive signal and a respective sample selector adapted to produce a respective plurality of sample streams" in the form of

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elements 6 and 42 of Figure 4, which are described at column 9, lines 40-52 and column 12, lines 50-52. Applicant disagrees with the Examiner.

Brunner discloses:

"The output of each base band demodulator 40 is coupled to an analog to digital converter 42, which operates to generate digital samples representative of the base band version of the radio signals provided by the respective base band demodulator 40. Although there are only three receive antennas 6 shown in FIG. 4, any number of receive antennas 6 could be used which would be coupled to a corresponding base band demodulator 40 and analog to digital converter 42. Each of the analog to digital converters 42 feeds over sampled signals on conductors 18 to a corresponding rake finger 44 forming part of the data recovery means 16. The rake fingers 44 form part of a two-dimensional-space frequency rake receiver. Each of the rake fingers 44 is provided with a first 46 and a second 48 correlator configured to receive the over sampled signals in parallel" (emphasis added).

Brunner does not disclose "a respective sample selector adapted to produce a respective plurality of sample streams" (emphasis added). An example of such a sample selector is located in Figure 12 of the present application as sample collector 226, which extracts odd and even samples produced by the ADC 224 and produces odd and even sample streams. Brunner provides the output of ADC 42 in parallel, that is the same signal is provided to first and second correlators 46,48; there is no sample selection that is performed.

The Examiner alleges that Lundby discloses "a MIMO (Multiple Input Multiple Output) decoder adapted to perform MIMO processing on the pre-combined signals" in the form of FEC decoder 222 in Figure 3, which is described at column 8, lines 22-34. Applicant disagrees with the Examiner.

Lundby discloses an FEC decoder. The present application discloses as FEC decoder as indicated by reference character 254 in Figure 12, which performs substantially the same FEC decoding functionality as FEC decoder 222 in Lundby. The MIMO decoder, an example of which is indicated by reference character 250 in Figure 12, receives "a respective plurality of

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sample streams"; for example, again referring to Figure 12, odd and even sample streams provided by ADC 224 and performs MIMO processing on the signals. In Lundby, FEC decoder 222 receives the output of MUX 220, a single stream and performs forward error correction processing. The MIMO decoder recited in claim 26 performs a completely different function than the FEC decoder disclosed in Lundby.

Applicant submits that for at least the above-discussed reasons, the combination of Feuerstein, Lundby, McGuffin and Brunner does not disclose all the limitations recited in claim 26. Furthermore, Applicant submits that none of Lundby, McGuffin or Brunner disclose the limitation missing from claim 26, which is alleged to be disclosed by Feuerstein. Applicant submits that the Examiner has failed to satisfy at least one necessary requirement to establish a *prima facie* case of obviousness, namely that the combination of references teach all the limitations of the claim 26.

For at least the above-discussed reasons, it is respectfully submitted that the Examiner has failed to meet all the necessary requirements for establishing a *prima facie* case of obviousness against claim 26. Applicant submits that claim 26 patentably distinguished over the combination of Feuerstein, Lundby, McGuffin and Brunner. Applicant respectfully requests that the Examiner reconsider and withdraw the obviousness rejection.

Claims 27 to 30 are dependent upon claim 26, either directly or indirectly. The Examiner bases the rejection of claims 27 to 30 on Feuerstein, Lundby, McGuffin, Brunner and for several of the claims, U.S. Patent Application Publication 20030080890 (Hilton). For at least their dependence upon claim 26, Applicant submits that claims 27 to 30 patentably distinguish over the cited references.

The Examiner has rejected claim 49 under 35 U.S.C. 103(a) as being unpatentable over the combination of Feuerstein, Lundby and U.S. Patent Application Publication 20020173302 (Baker).

Claim 49 is dependent upon claim 48. Applicant submits that Feuerstein does not disclose what is recited in claim 48 for at least the reasons discusses above with regard to the anticipation rejection of claim 48. Applicant further submits that neither of Lundby or Baker disclose the features missing from claim 48, which are alleged to be disclosed by Feuerstein. For

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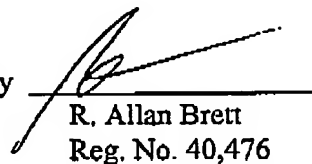
at least its dependence upon claim 48, Applicant submits that claim 49 patentably distinguishes over the cited references.

In view of the forgoing, early favorable consideration of this application is earnestly solicited.

Respectfully submitted,

SHIQUAN WU ET AL

By


R. Allan Brett
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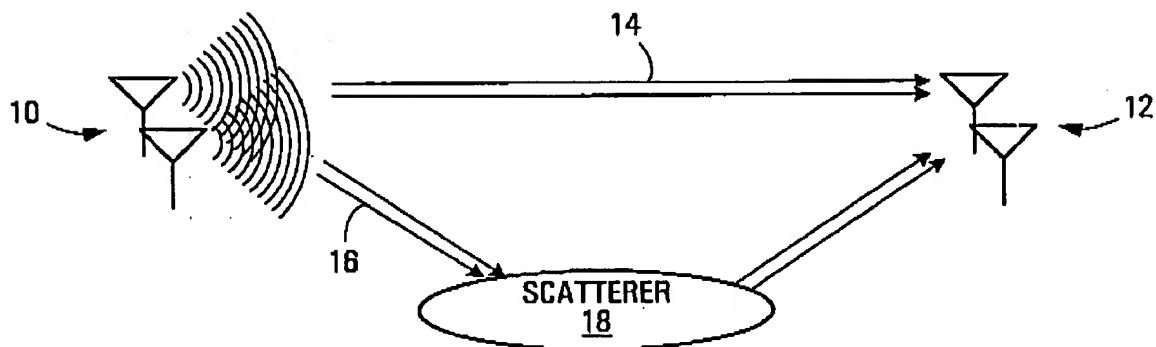
Date: May 8, 2007

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VIRTUAL MIMO TRANSMITTERS, RECEIVERS, SYSTEMS AND METHODS

ANNOTATED SHEET SHOWING CHANGES

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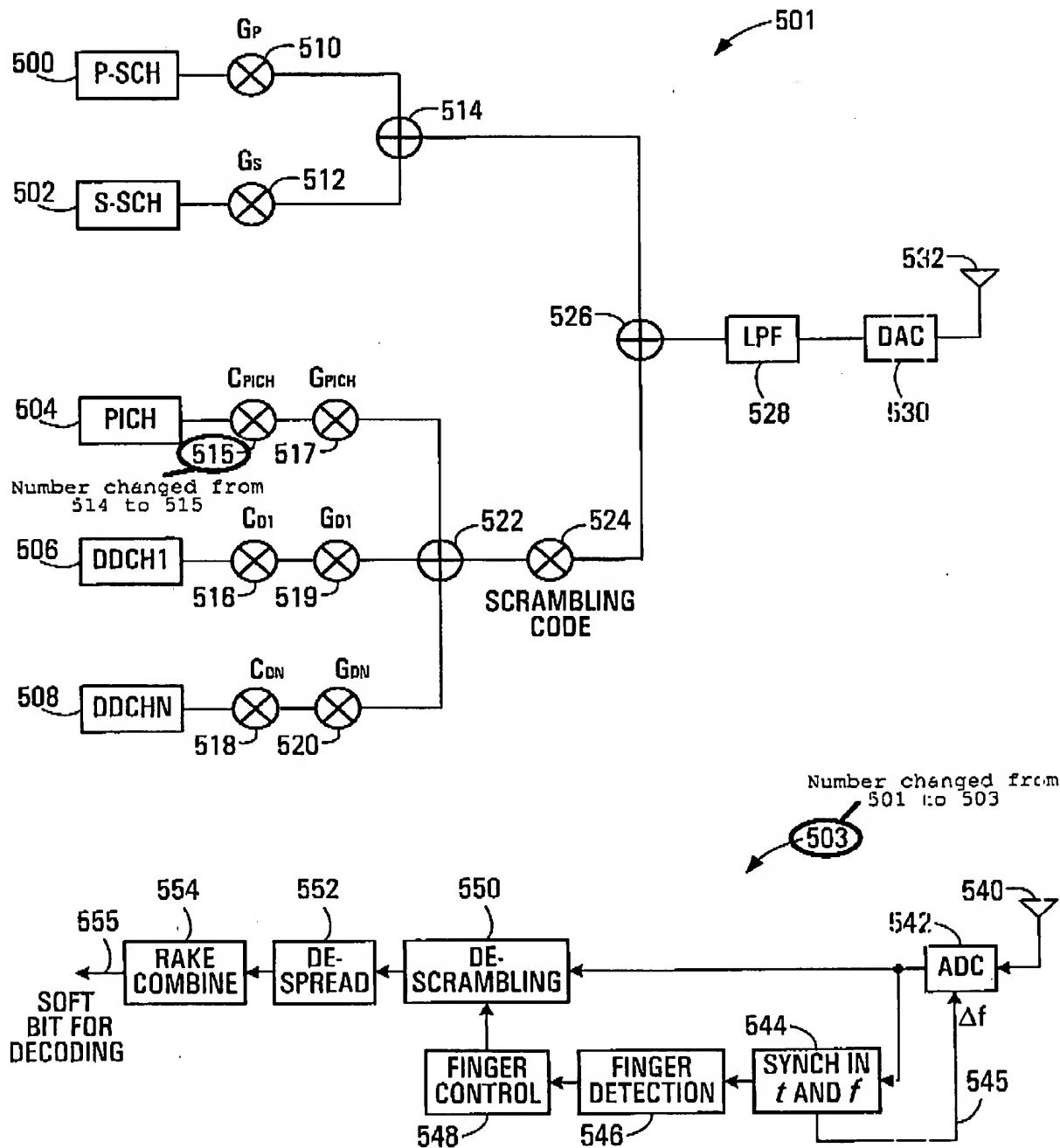
**FIG. 1****(Prior Art)**

Text added: prior art

VIRTUAL MIMO TRANSMITTERS, RECEIVERS, SYSTEMS AND METHODS

ANNOTATED SHEET SHOWING CHANGES

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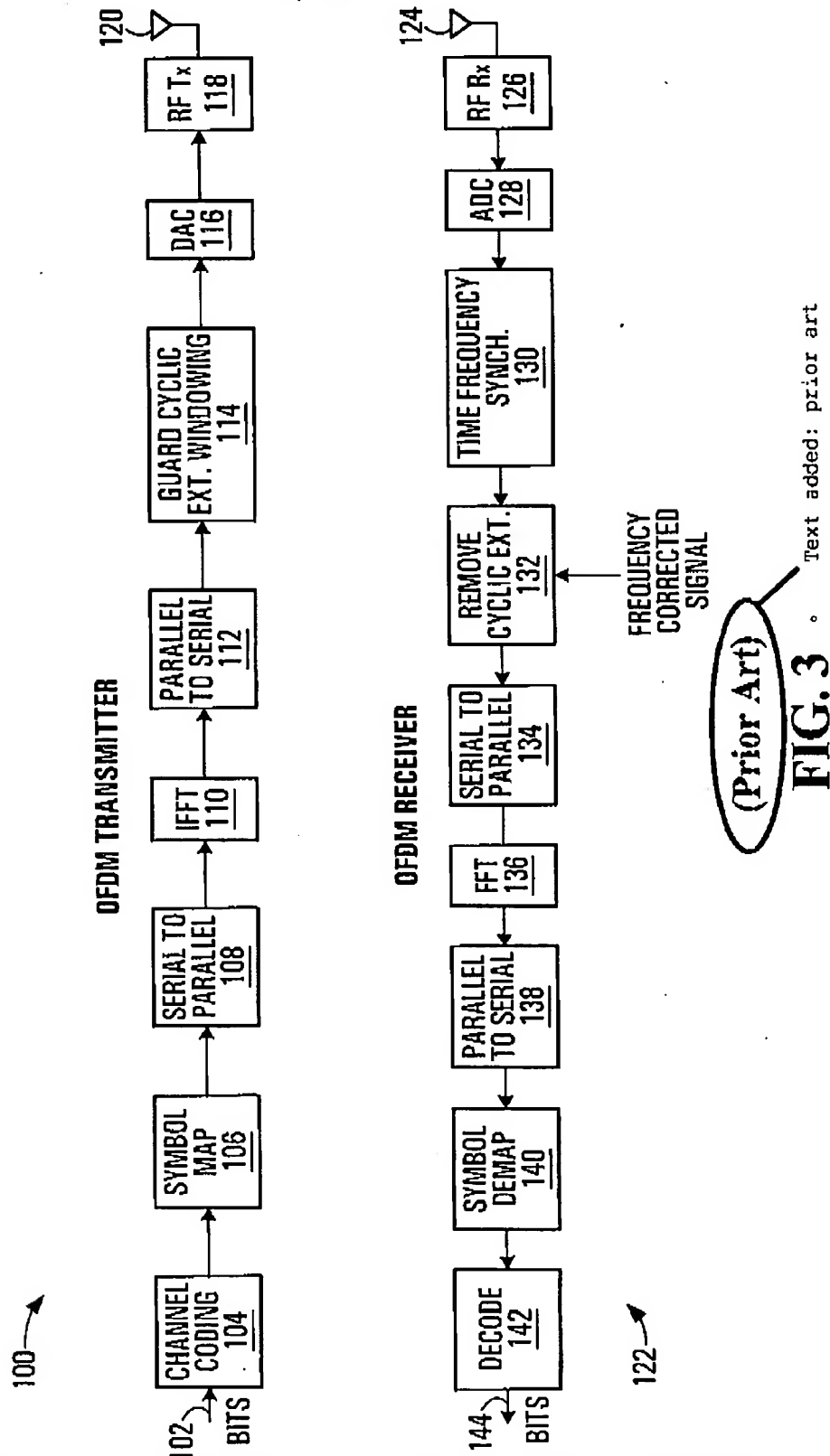
(Prior Art)

FIG. 2

Text added: prior art

ANNOTATED SHEET SHOWING CHANGES

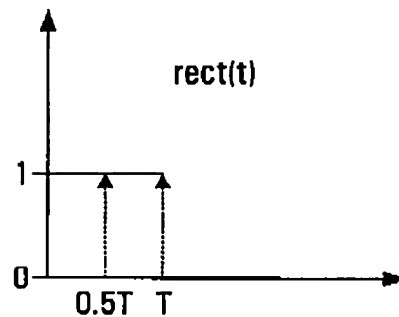
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VIRTUAL MIMO TRANSMITTERS, RECEIVERS, SYSTEMS AND METHODS

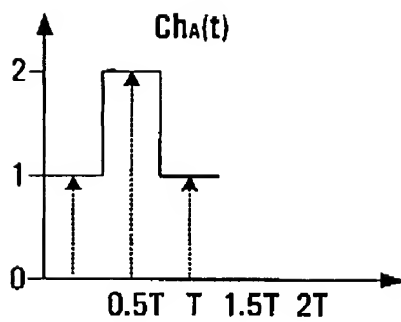
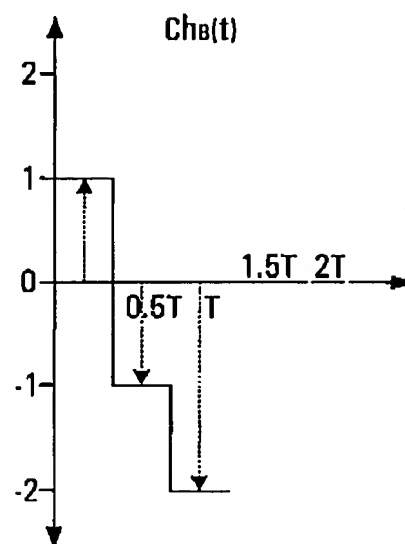
ANNOTATED SHEET SHOWING CHANGES

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**FIG. 10A**

(Prior Art)

Text added: prior art

**FIG. 10B****FIG. 10C**